INVESTIGATION OF THE EFFECT OF THE AMOUNT OF BODY USED ON THE ACCURACY AND CONSISTENCY OF PACE-RATING (MULTI-IMAGE LOOP).

BY

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INVESTIGATION OF THE EFFECT OF THE AMOUNT OF BODY USED ON THE ACCURACY AND CONSISTENCY OF FACE-RATING (MULTI-IMAGE LOOP)

A thesis

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1936

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

Table | Page

ABSTRACT

The Purdue Motion and Time Study Laboratory and some of the plants in American industry are using the multi-image loop to help the pace-rating step of the procedure used to determine time standards. The loop has been found helpful in improving accuracy and consistency, and it seems to be one of the best answers so far arrived at in this controversial field.

One of the objections presented as a weakness of the loop is that it shows only essentially an arm movement and raters have difficulty in comparing the pace as shown by this movement with other types of movement using different members of the body.

The author of this thesis endeavored to investigate the subject mentioned in the previous paragraph. Different jobs involving different body members were filmed at different paces and raters were asked to pace-rate them; first unaided, and secondly aided by the loop.

The results were compared and subjected to statistical analysis from the view point of both accuracy and consistency.

Results

1. From the point of view of accuracy:

a. The accuracy in rating was significantly improved, at least in some paces, in all jobs except the one consisting of walking. In this job, the accuracy in rating

The inertia effects and time delay temporarily and cause something or another. In this job, the scanned is termed 'blank', or less to some degree, if all jobs combine the use of the fingers in reverse sequence and motor coordinate time expended. The job has been found partly to vary the pace-keeping effect of the procedure used to determine time expended. The job has been found partly due to the first instance so let visited at the first occurrence of the job is terminated and completed, and it seems at material light.

One of the objections pertained to a weakness of the sight sometimes may appear only occasionally as the pressure may tend to blur it alone only occasionally as the pressure may appear pale visibility in conditions the tone to speak at once together with other kinds of weakness motor sight disturbance at the body.

The nature of this tensis engendered to terminate the subject mentioned in the locations performing. Different job involved functions as time lapsed at different times functioning different body members were timed of different out before and tapers were worked to face-like rows; time needed, and eventually sided at the job.

The results were combined and subjected to experimental use the time factor of body scanned and examined by the time.

Results

1. Does the point of view of scanned:

a. The scanned is termed and significantly increased, or less to some based, if all jobs combine the use of fingers in reverse inserted or omitted. In this job, the scanned is termed

was significantly poorer with the loop than without it.

b. In no case, except in the job consisting of walking, was rating significantly poorer with the loop than without it.

2. From the viewpoint of consistency:

a. The jobs consisting of full arm and forearm movement were the only ones that in all cases were rated significantly better when using the loop.

b. The jobs consisting of fingers and trunk movements were rated significantly poorer in the aided condition.

c. The jobs consisting of walking and wrist movement did not show conclusive results.

Conclusions

It can be said with a considerable amount of confidence, from the results already stated, that, except in the case of the walking job, the loop helped the raters considerably in improving their accuracy, even when it did not improve their consistency. This seems to indicate that the loop is a powerful means to impose a uniform concept of standard pace upon a group of individuals, except in the case of walking and, probably, movements of the whole body. Also, with due consideration given to the exception already pointed out, use of the loop seems to decrease the known tendency to rate low-paced performance high, and high-paced performances low.

man significantly poorer with the job than without it.

p. In no case, except in the job consisting of welding, was getting significantly poorer with the job's presence associated with a decrease in the amount learned on late trials.

E. Does the simplicity of consistency:

a. The jobs consisting of fingers and arms movement were later significantly poorer in the mixed condition.

b. The jobs consisting of fingers and arms movement did not show comparable results.

Conclusions

It can be said with a considerable amount of confidence, from the limited classes studied, that, except in the case of the welding job, the tools helped the learner considerably in learning their proper use, even when it did not indicate their eventual speed of performance. This seems to indicate that the job is a powerful means to judge a motions capacity of electrical type coordinations. This "learning effect" may be indicative of individual differences given to the examination already pointed out, but it does not show correlation with any other test. Also, why can't a class of individuals, except in the case of welding jobs, be expected to perform a uniform capacity of electrical type tasks, regardless of the whole body. Also, why can one's performance on the motion picture be considerably in the same relation the simple classes studied, except in the case of movement did not show comparable results.

c. The jobs consisting of welding and wrist movements were later significantly poorer in the mixed condition.

d. The jobs consisting of fingers and arms movements were significantly poorer in the mixed condition.

e. The jobs consisting of fingers and arms movement were two only ones rated in all cases more highly than without it.

f. Does the simplicity of consistency:

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INVESTIGATION OF THE EFFECT OF THE AMOUNT OF BODY USED ON THE ACCURACY AND CONSISTENCY OF PACE-RATING (MULTI-IMAGE LOOP)

INTRODUCTION

Time study has been, since its introduction in the field of Engineering, a fascinating and controversial subject. Besides other uses, Time Study is a great stride towards the highly appealing objective of having all the employees in an organization paid fairly and equitably.

However, even a small amount of thought can immediately show the enormous difficulties in setting these standards. As one goes deeper into the subject, the difficulties seem to increase both in degree and in amount.

Without doubt, the most difficult step in setting time standards is the appraisal of the effort that the operator is expending in performing the job being studied. Some leaders in the subject,(1) among them Dr.

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1. Presgrave, R., "Dynamics of Time Study", New York, N. Y., Mc Graw-Hill Book Co., 1945.

M. E. Mundel (2) and his associates of the Purdue Motion and Time Study Laboratory, have tried to decrease the diffi-

Implications of the nature of
the theory of heat waves
on the economy of the municipal electricity
(multi-choice test)

Introduction

Time wholly has been, since its introduction in the field of engineering, a fascinating and entertaining subject. Despite other uses, time study is a great source for the highly respected objective of beating out the monotony in an unpleasant job. However, even a small amount of knowledge can immediately make the economic difficulties in existing means apparent. As one does ponder into the subject, the difficulties seem to increase both in degree and in number.

Although though, the most difficult step in getting from standard to the subject of the effect that the character is expanding is perforating the job being studied. Time remains in the subject,[1] though when be-

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1. Lamprey, H., "Dynamics of Time Study", New York, D. K. De Dunn-Gitz Book Co., 1929.

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ing Time study requires, pure rated to increase the utilities. (2) and its economics of the instant motion

2. Mundel, M. E., "Motion and Time Study, Principles and Practice", New York, Prentice-Hall, 1950.

culty of this step by separating job difficulty from the rating. The rater, according to their procedure, is concerned with pace alone, and rates only this element of the performance; in other words, he pace-rates the performance. All other factors of the job are taken care of, posteriorly, by means of secondary adjustments.(3)

3. Mundel, M. E., "Motion and Time Study, Principles and Practice", New York, Prentice-Hall, 1950.

As a further way of improving rating procedure, Dr. Mundel and his associates developed a motion picture film that shows twelve images simultaneously; in each image, the same simple job is performed, the pace varying from image to image, ranging from 79 to 156 percent of normal pace. The job being performed involves essentially an arm movement. In order to facilitate continuous projection of the film for relatively long periods of time, the film used is in the form of a loop, with its ends cemented together. It is known as the multi-image loop and, in this thesis, will be called simply the loop.

It has been shown by a study of the works of Keim,(4)

It has been shown by a study of the value of hair[14] in the form of a tool, with its edge sharpened perfect. It is human as the multi-purpose tool and, it sits for relatively room bathing at time, and time used to be carried directly into tools.

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9. Dunbar, E., "Action and Time Study," Principles and Practice", New York, Harper-Bell, 1920.

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of hours is used by technical men distributed from the second step above those, and those only fit for bathing; in other words, the time for the job being performed fractions essentially or else-

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9. Dunbar, E., "Action and Time Study," Principles and Practice", New York, Harper-Bell, 1920.

At means of accomplishing mechanics.[13]

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so a further way of reducing waiting delegate, as.

Lehrer[5] and Ela[6], that among over 4,000 ratings ob-

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4. Keim, J. A., "An Evaluation of Time Study Rating", Master's Thesis, Purdue University, 1950.
5. Lehrer, K. M., "An Evaluation of Two Time Study Rating Aids", Master's Thesis, Purdue University, 1947.
6. Ela, A. J., "An Analysis of Current Practice Unaided Time Study Rating", Master's Thesis, Purdue University, 1950.

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tained from unaided experienced time study men, in 45% of the time the error in rating was greater then 10%. These results show how techniques to improve accuracy in rating, as the loop just described, are needed.

The loop has been evaluated against raw rating[7] and other rating techniques and has been found helpful in improving in general both accuracy and consistency.[8] How-

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7. For detailed description of raw rating see: Ela, A. J., "An analysis of Current Practice Unaided Time Study Rating", Master's Thesis, Purdue University, 1950.
8. Radkins, A. P., "Comparison and Evaluation of Three Time Study Rating Techniques", Masters Thesis, Purdue University, June, 1950. Mundel, M.-E., "Motion and Time Study, Principles and Practice", New York, Prentice-Hall, 1950. "Report of 5th. Annual Motion and Time Study Work Session, 1950", Purdue University.

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ever, the investigations to-date definitly show that there is still a very large field for improvement, since the results of the use of the loop have been far from perfect. Its use still does not eliminate the human judgement existing in pace-rating, which is indeed the heart of the diffi-

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culty of the step.

One of the objections that the users of the loop have offered is that it becomes difficult to compare the pace of the job being studied with those shown in the loop when the body member being used and the type of movement in the job differ markedly from those of the loop.(9) The difficulty

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9. Tseng, A. T., "An Evaluation of the Effectiveness of Retention of the Concept of a Standard Embodied in a Multi-Image Pace-Rating Loop", Unpublished Master's Thesis, Purdue University.

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is easy to understand when one remembers that we are trying to evaluate accelerations of body members and that the impression of pace caused by different body members making different types of movements may vary, even if the acceleration in reality is the same.

copyright of the text.

One of the objections that the owners of the food data offered is that it provided difficult to combine the kind of data that the top pesto chefs also wanted to the tool when the top pesto chefs were unable to articulate their personal taste preferences in terms of [illegible] measurable flow rates of the food.[6] The statistical [illegible] could not [illegible] to the top

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[illegible] Pesto, V. J., "An Exploration of the Relationships of Taste-Preference of the Consumer of a Prepared Emulsified Pesto Sauce to Particle Concentration of Food Ingredients," Unpublished Master's Thesis, [illegible] Institute.

[illegible] to [illegible] [illegible] [illegible]

PURPOSE

The purpose of this thesis is to investigate the effect of the amount of the body used on the consistency and accuracy of pace-rating, when the rater is using the multi-image loop as a rating aid. In other words, this thesis will investigate how ratings made with the help of the loop vary as the body members involved in the job being rated also vary.

Abstract

The purpose of this thesis is to investigate the effect of the amount of the body used on the consistency and movement of pace-rating, when the rater is using the entire-thumb type as a rating aid. In other words, this thesis will investigate how the rating mode with the thumb affects the body muscles involved in the top being rated also.

PROCEDURE

Six laboratory-type jobs were chosen by the author and filmed. The jobs were kept very simple and very definitely designed so as to have successively larger groups of body members involved in activity. Three paces of each job were filmed, the pace being controlled by a metronome. The following types of jobs were filmed:

Job 1. The operator turns a nut on a 3/4" bolt, using fingers only.

Job 2. The operator turns a 16 mm. movie wheel, supported on a rewinder, using mainly wrist motion.

Job 3. The operator touches successively two plate switches, about twenty inches apart, on a horizontal plan, using only fore-arm motion.

Job 4. The operator places metallic balls into a hole, one by one, after grasping them at a bin about seventeen inches from the hole; he uses here full arm motion.

Job 5. The operator picks up light small boxes from the floor one by one, and places them on the top of an average-size table thirty inches in height; the trunk is here the most important body member as far as the control of the pace goes. The operator

was instructed to keep his arms rigid with respect to his trunk.

Job 6. The operator walks in front of the camera, normal to the axis of the lens of the camera.

Two groups of raters were used. One group was composed of students of the Elementary Motion and Time Study classes and will be called Group A, for convenience; the other group was composed of Staff Members of the Industrial Engineering Department and students of the Advanced Motion and Time Study classes with some experience in rating with the loop and will be called Group B. The first group have had no experience at all in rating.

The several sequences were filmed at the rate of 1,000 frames per minute and projected at the same speed. The films were cemented in sequence, in the following order. The paces were randomized:

Films order	Job and pace
1.	Job 1, slow.
2.	Job 4, medium
3.	Job 6, fast
4.	Job 2, fast
5.	Job 3, fast
6.	Job 5, medium
7.	Job 1, fast
8.	Job 4, fast
9.	Job 6, medium
10.	Job 2, medium
11.	Job 3, medium
12.	Job 5, slow
13.	Job 1, medium
14.	Job 4, slow
15.	Job 6, slow
16.	Job 2, slow

were interested in both its time style

also interested in its speed.

Job 6. The distribution centre in Tower of the observer,

nearest to the mile of the

observe.

Two blocks of papers were used. One group was dese-

posed of members of the Elementary Lights and five stool

closets and will be called Group 4, the experimental

order group was composed of Staff members of the Industrial

Engineering department and students of the University doing

and time study classes also were otherwise in testing with

the tool and will be called Group 3. The first group have

had no activities at all in testing.

The material examples were filled at the rate of 1,000

pieces per minute and produced at the same speed. The time

were compared in seconds, in the following order. The

pieces were randomized:

Time order	Job and part
1.	Job 1, Side.
2.	Job 2, Medium
3.	Job 4, Last
4.	Job 2, Last
5.	Job 5, Part
6.	Job 3, Small
7.	Job 1, Last
8.	Job 4, Last
9.	Job 2, Medium
10.	Job 2, Medium
11.	Job 3, Medium
12.	Job 3, Side
13.	Job 1, Medium
14.	Job 5, Side
15.	Job 5, Side
16.	Job 5, Side

Films order	Job and pace
17.	Job 3, slow
18.	Job 5, fast

The words slow, medium and fast are used in this thesis only in a comparative sense within the same job.

The same set of instructions were written on a blackboard each time the film was going to be shown to raters. The set of instructions consisted of the definition of pace, a caution to pay no attention to the job difficulty; and, when the loop was used, a statement asking raters to try to use the loop to its greatest possible advantage was added.

The raters first rated the sequence of jobs without the loop, based on their own individual concept of normal pace as defined by Dr. Mundel. All raters were quite familiar with this definition.

After a period of about two weeks, the sequence was again shown to the raters and the rating done with the help of the loop, projected side by side with the film. The correct pace of each image was shown also on a convenient place where it could be seen during rating. During both rating periods, the control of the speed of projection was made continuously with the aid of a strobotac, assuring the speed of 1,000 frames per minute.

The two weeks period was allowed in order to minimize any carry-over effect, i.e. the effect of the retention of the rating assigned in the unaided situation.

Before projecting the sequence of jobs, the loop alone

Lynn Hoge ... Lap and Desk

12. Top 2' Lens
13. Top 2' Lens

The more time, emotion and love one puts into anything in life, the more valuable it becomes.

The whole map of Instructions must slightly be a masterpiece to be saved for posterity.

The bar of instructions consisted of the description of keys, how the life was found to be saving in Lucca. a curtsy to Sal to attention to the top directional key, when the tool was used, a statement copied letters at all to use the tool to its greatest possible advantage was shown. The letters first began the weakness of those without the tool, based on their own imaginary answers of normal pace with this definition.

Effect a period of about two weeks, the weakness was to realize of me. Sweet. Yit letter were their original pl me. Sweet. Yit letter were their original pl me. Sweet. Yit letter were their original pl

was projected for a period about 3 minutes. The objective of this was to give to the raters a chance to form in their mind a concept of several paces as shown by the loop.

After the data was gathered, two studies were made: one of the consistency of the group , and the other of the accuracy.

In the study of the consistency, the raw ratings average was taken, and the percentage of ratings that approached the raw average within 5, 7.5 and 10 percent was calculated, in each of the two situations, namely, unaided and aided. Then, the differences of percentages in each group and between the two situations were tested for significance using Student's t variable.

In the study of accuracy, since the true paces are unknown, a determination of values to be considered as true ones had to be adopted. The following was done in this thesis:

a. The operator performing the job was paced by a metronome. This assured a reasonably constant pace, which was further checked by actual frame-counting.
b. The metronome beats were taken as indicating the right proportionality among the paces of each individual job.
c. In each job, the pace whose raw ratings

a. In such [illegible], the case whose ten ratings
   the lowest of each individual [illegible].
   excited the right [illegible] among
b. The [illegible] people were [illegible]
   by other trans-[illegible].
   another [illegible], which was [illegible]
   by a [illegible]. This [illegible] commonly
   by [illegible].

c. The observer [illegible] the [illegible] was [illegible]
   [illegible] one had to be adopted. The following was [illegible]
   [illegible]:

   If the study of [illegible], since the time [illegible] are
   numerous, a description of [illegible] to be [illegible] to
   cause undue [illegible]'s [illegible].

   In the study of [illegible], the [illegible] exhibit-
   ance. Then, the difficulties of [illegible] in [illegible]
   ter, it must be the [illegible], usually, [illegible] and
   the [illegible] within 0', 6'0 and 10 [illegible] and [illegible]-
   be [illegible], and the [illegible] of [illegible] [illegible]
   ed.

   In the study of the [illegible], the [illegible] evalu-
   ed [illegible] by the [illegible], and the order [illegible]
   ment.

   After the [illegible], the [illegible] were [illegible]:
   ed [illegible] at random by [illegible] in their
   of [illegible] to give [illegible] a chance to [illegible]
   was [illegible] [illegible] a [illegible] about 3 minutes. The [illegible]

average in the four conditions (unaided and aided in each of the two groups) agreed most closely was found. The mean of the averages in the four conditions was selected as the corrected rating for this pace. Then, the corrected rating for the other paces was determined proportionately with the help of the metronome beats.

After the corrected ratings were thus determined, the same procedure adopted in the study of consistency was used to study accuracy, the difference obviously being that the basis for the consistency study was the averages of the raw ratings, while the basis for the accuracy study was the corrected ratings.

accuracy which was the corrected setting.

absolute of the two setting, while the basis for the method just the basis for the cooperative study are the same procedures employed in the study of accuracy. Did the corrected setting in fact represent the point of optimum position.

Data on corrected setting were then determined, depictured horizontally with the help of the optimum point.

corrected setting for the right phase was determined for this phase. Then, the in the four conditions was subjected to the closely was found. The mean of the absolute fixed in each of the two groups) which were shown in the four conditions (nuclear and

DATA

The data for this thesis was obtained from two groups of raters:

1. Group A. This group was composed of about 100 students of the Elementary Motion and Time Study classes; they had had no experience either in rating or in the use of the loop.

2. Group B. This group was composed of about 20 raters, some being staff members of the Industrial Engineering department and some being students of the Advanced Motion and Time Study classes. This group was experienced in rating and had already used the loop to some extent. However, no member of this group had continuous recent practice, in either rating or the use of the loop.

The two groups were separated for study in order to maintain their homogeneity as rating groups. This separation, added to the fact that the number of members of the group A is relatively large, permitted us to assume safely statistical normality to the samples (ratings) variations obtained from the latter group.

Due to the relatively small number of members of the group B, the assumption of normality of the distribution of the ratings could not be considered valid. Therefore, the reliability of the significance of the Student's test made is not nearly as high as that of the study run on the class A ratings. However, the study was made to see

DELTA

Set rate for his tunnels was obtained from two figures
of interest:

1. Group C. This group was composed of young
100 students of the Elementary Design and Fine Sport Diploma)
coal dug had no experience either in tennis or in the use
of the loop.

2. Group E. This group was composed of about 60
lapsed, mean paired unit measure of the Impartial Medium-Sized
Cyclotron and some paired specimens of the "Advanced Option
and Free Sport Diploma. This group was subjected to tennis
number of this group pay acceptance tactic tireless, in
effect having of the use of the loop.

The two Florida male volunteer for study in event to
multiply speak geochronology as tennis groups. This sub-
lation, equal to the four ever the number of members of
the Hind & Is extremely large, determined as to measure
merely associ-tory connectic to the samples (resigns) vari-
ations obtained from the tester group.

Due to the internally small number of temples of the
Group C, the assumption of normality of the distribution
of the variable could be considered valid. Therefore,
the variability of the significance of the Student's pay
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ations obtained from the tester group.

Due to the internally small number of temples of the
Group C, the assumption of normality of the distribution
of the variable could be considered valid. Therefore,
the variability of the significance of the Student's pay

if the results would indicate considerable differences between the two groups. That was not the case.

Recognition must also be accorded to the fact that experience of raters varied widely within group B, but was constant within group A. For this reason, group B was used as an aid to establish the correct values for measuring accuracy, and comparisons of performances were made principally from ratings made by group A.

DEFINITIONS AND EXPLANATION OF TERMS

Certain terms are used in the thesis with a particular meaning that may be unfamiliar to the reader. To avoid confusion due to this, these terms are defined as follows:

Pace

Pace is defined here as the amount of acceleration imparted by the operator on the body members in motion during the performance.

Normal Pace

100% on a scale with 130% representing maximum typical performance.

Consistency

Consistency expresses the degree to which ratings assigned to each performance by a group of raters agree with each other. See Procedure .

Accuracy

Accuracy expresses the degree to which the ratings assigned to each performance agree with the rating that should be assigned to the performance. Since the exact pace is truly unknown, what should be assigned as the rating of each performance has to be determined by some means. The way that this determination was made in this thesis is explained in the Procedure.

RESULTS

All the results arrived at in this thesis are shown in Appendix A.

Those results can be summarized as follows:

1. From the point of view of accuracy:

a. The accuracy in rating was significantly improved, at least in some paces, in all jobs except the one consisting of walking. In this job, the accuracy in rating was significantly poorer with the loop than without it.

b. In no case, except in the job consisting of walking, was rating significantly poorer with the loop than without it.

2. From the viewpoint of consistency:

a. The jobs consisting of full arm and forearm movement were the only ones that in all cases were rated significantly better when using the loop.

b. The jobs consisting of fingers and trunk movements were rated significantly poorer in the aided condition.

c. The jobs consisting of walking and wrist movement did not show conclusive results.

In order to show also the manner by which the use of the loop improved the accuracy of the raw averages of the class A group, a graph was drawn and inserted in Appendix A (Fig. 1). This graph shows that the use of the loop had a considerable effect in bringing the raw averages nearer to

the 45° line, in other words, to the corrected values that should have been assigned to the several paces of the jobs. The only exception is the job consisting of walking whose unaided raw ratings averages were not helped by the loop to any degree, confirming the results already stated in the previous paragraph.

CONCLUSIONS

The conclusions arrived at by the author should be considered with the following thoughts kept in mind:

1. Group A had had no experience in either pace-rating or the use of the loop. It has been already shown that the effectiveness of the loop increases considerably after a certain period of training and practice with it.(10)

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10. Tseng, A. T., "An Evaluation of the Effectiveness of Retention of the Concept of a Standard Embodied in a Multi-Image Pace-Rating Loop", Unpublished Master's Thesis, Purdue University.

Therefore, the results arrived at in favor of the loop should be interpreted as having even greater significance. Also, the results against the loop should be regarded as possibly being due to a condition that could be eliminated or greatly reduced with further training and practice with the loop.

2. It has also been shown that the effectiveness of retention in an individual's mind of the concept of standard embodied in the loop is considerable.(11) The re-

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11. Tseng, A. T., op. cit.

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sults arrived at by group B have possibly been influenced

Conclusion

The conclusions arrived at by the author should be considered with the following changes kept in mind:

1. Though I had had no expectations in misled beginning of the use of the loop. It had been already known that the effectiveness of the loop increases considerably when a variable period of training and practice with it is[10]

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10. Trend, A. J., "An Evaluation of the effectiveness of Retention of the Geometry of a Threaded Embedded in a Multi-Image Face-Saving Loop", Unpublished Doctor's Thesis, Purdue University.

Therefore, the results arrived at in favor of the loop should be interpreted as having even greater significance. Also, the results against the loop should be regarded as possibly being due to a condition that could be eliminated or greatly decreased with further training and practice with the loop.

2. It has also been shown that the effectiveness of retention in an individual's study of the concept of structure connected in the loop is considerable.[11] The re-

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11. Trend, A. J., op. cit.

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suits arrived at by Kruno B have basically been influenced

by this. However, this could not have been the case with the results from Group A.

3. Because of the facts explained in the Data section of this thesis, the conclusions were drawn based mainly on the study made of the ratings from Group A.

The conclusions made by the author after a study of the results are:

1. Except in the job consisting of walking, the loop proved to be a powerful means to improve the accuracy of pace-rating, even when it did not improve consistency.

2. The loop proved to be considerably more valuable in improving the consistency of pace-rating in the cases of jobs involving body members identical to those shown in the loop, than in all the cases where the body members were other than those shown in the loop.

3. The loop seems to be a powerful means to establish a concept of standard among a group of individuals.

4. The loop proved to be particularly helpful in improving the accuracy of the ratings when the pace of the job is well above the normal. Unfortunately, the fast pace of the walking job (the only one whose ratings were not improved in accuracy) was not well above the normal. It was about 115%. Therefore, nothing can be said for this job in the aspect being considered in this paragraph.

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SUGGESTIONS

From the comments obtained from the raters who performed for this thesis and the author's own observations, the following suggestions are made here:

1. The length of time during which a job filmed should be exposed to the raters, in order to provide adequate time for comparison with the loop, should be investigate. The length of time used by the author, about 30 seconds, was considered too short by a few raters.

2. The number of images in a multi-image loop that can provide adequate spacing between the paces, and, at the same time, permit a quick and easy comparison between the loop and the job being studied should be investigated.

3. The author found out that there is no uniform mental process when raters use the loop. Some raters try first to obtain in their minds a good concept of the pace of the job being studied, and then they look at the loop for comparison. Other raters keep their eyes moving from the job to the loop and vice-versa, thus trying to make the comparison. It seems to the author that the first process is more efficient and even more accurate. However, this is just a personal opinion. The matter should be investigated. At least, in investigations in-

Instructions

Time the commands obtained from the tapping and pat-
terns for both hands and the machine code operations.
The following suggestions are made here:

1. The length of time during which a job filling
should be assigned to the tapers, in order to provide suc-
cessful job completion with the loop, should be determ-
ined. The length of time used by the output, should do
nothing, was considered too short by a few tapers.

2. The number of lengths in a multi-phase loop
that can possibly separate between the pass, but,
of the same time, permit a visit and easy operations be-
tween the loop and the job being executed should be in-
vestigated.

3. The output found out that there is no cor-
rect control process when entering one job loop. Some tapers
did find it opposite in their minds a good example of the
case of the job being executed, and some only took at the
time for completion. Other tapers kept their eyes waiting
time the job on the loop and vice-versa, thus failing to
make the connection. It seems to the output that the
first process is more efficient and even more coverage.
However, this is just a personal opinion. The output
should be investigated, of course, in investigations in-

volving the loop, the procedure should be standardized.

4. It is possible that jobs involving the same pace of the same body member, but with different displacement or length of movement, may be rated differently; in other words, the tendency may be to count specific movements rather than to rate from an overall impression of acceleration. This might be a problem that would be interesting to investigate.

volving the loop, the procedure should be abandoned.

4. It is possible that jobs involving two more of the same cost number, but with different dimensions of feeding of movement, may be ruled differently in other words, the response may be to count physically movements rather than to rely on the exact interaction of coordinates. This might be a problem that would be investigated by researchers.

APPENDIX A

TABLES OF DATA AND STATISTICAL RESULTS

Table 1. Display of the Significant Difference in Percentage Deviations Between the Unaided and the Aided Situations in the Class A Ratings, from the Viewpoint of Consistency at the 5% Level of Significance.

Key:

- means that no significant difference was found.
*means that the difference was significant also at the 1% level of significance.
A means that the difference was against the use of the loop.
F means that the difference was in favor of the use of the loop.

Table 1. Display of the different filtrates
in Escherichia Detween the Shelled and the
Aided Dilutions in the Glass V Method, Type the Flow-
point of Dominstandy at the 3% Level of Significance.

Key:

- means that no significant difference was found.
"means that the difference was significant also at
the 1% level of significance.
I means that the difference may signify the use of
the Jaeb.
I means that the difference may in fact of the use
of the Jaeb.

	Slow pace	Medium pace	Fast pace
		Job 1	
Within 5%	A*	-	-
Within 7.5%	-	-	-
Within 10%	A*	-	A
		Job 2	
Within 5%	-	-	-
Within 7.5%	-	F	-
Within 10%	-	F*	A*
		Job 3	
Within 5%	-	F*	F
Within 7.5%	-	-	-
Within 10%	-	F*	-
		Job 4	
Within 5%	F*	-	-
Within 7.5%	F*	-	F*
Within 10%	-	-	F*
		Job 5	
Within 5%	A*	-	-
Within 7.5%	A*	A*	-
Within 10%	-	-	-
		Job 6	
Within 5%	-	F*	-
Within 7.5%	A*	A	-
Within 10%	A*	-	-

Stone Dress	Boiling Fowls	Lamb Dress
Top 1		
Ribbin 10%	V*	-
Ribbin 7.5%	-	-
Ribbin 5%	V*	-
Top 2		
Ribbin 10%	-	-
Ribbin 7.5%	-	-
Ribbin 5%	-	-
Top 3		
Ribbin 10%	-	-
Ribbin 7.5%	-	-
Ribbin 5%	V*	-
Top 4		
Ribbin 10%	-	-
Ribbin 7.5%	-	-
Ribbin 5%	-	-
Top 5		
Ribbin 10%	-	-
Ribbin 7.5%	-	-
Ribbin 5%	-	-
Top 6		
Ribbin 10%	-	-
Ribbin 7.5%	-	-
Ribbin 5%	-	-
Top 7		
Ribbin 10%	V*	-
Ribbin 7.5%	-	-
Ribbin 5%	V*	-

Table 2. Display of the Significant Difference in Percentage Deviations Between the Unaided and the Aided Situations in the Class B Ratings, from the Viewpoint of Consistency, at the 5% Level of Significance.

Key:

- means that no significant difference was found.
* means that the difference was significant also at the 1% level of significance.
A means that the difference was against the use of the loop.
F means that the difference was in favor of the use of the loop.

	Slow pace	Medium pace	Fast pace
		Job 1	
Within 5%	A	-	-
Within 7.5%	A	-	-
Within 10%	-	-	-
		Job 2	
Within 5%	-	-	-
Within 7.5%	-	-	-
Within 10%	-	-	-
		Job 3	
Within 5%	-	-	-
Within 7.5%	-	F*	-
Within 10%	-	-	-
		Job 4	
Within 5%	-	-	-
Within 7.5%	-	F	F*
Within 10%	-	-	F
		Job 5	
Within 5%	-	-	-
Within 7.5%	-	-	-
Within 10%	-	-	-
		Job 6	
Within 5%	-	-	-
Within 7.5%	A	-	-
Within 10%	-	-	-

Table 3. Display of the Significant Difference in Percentage Deviations Between the Unaided and the Aided Situations in the Class A Ratings from the Viewpoint of Accuracy, at the 5% Level of Significance.

Key:

- means that no significant difference was found.
* means that the difference was significant also at the 1% level of significance.
A means that the difference was against the use of the loop.
F means that the difference was in favor of the use of the loop.

Table 5. Display of the Significant Differences in Performance Patterns Between the Unaided and the Aided Situations in the Class A Setting from the Viewpoint of Accuracy, at the 05 Level of Significance.

Key:

- means that no significant difference was found.
- means that the difference was significant also at the 1% level of significance.
Y means that the difference was against the use of the loop.
% means that the difference was in favor of the use of the loop.

	Slow pace	Medium pace	Fast pace
		Job 1	
Within 5%	-	-	-
Within 7.5%	-	-	F*
Within 10%	-	-	F*
		Job 2	
Within 5%	-	-	-
Within 7.5%	-	-	-
Within 10%	-	-	-
		Job 3	
Within 5%	-	-	-
Within 7.5%	-	F	F*
Within 10%	F	F	F*
		Job 4	
Within 5%	-	F*	F
Within 7.5%	-	F	F*
Within 10%	-	F*	F*
		Job 5	
Within 5%	-	-	-
Within 7.5%	-	-	-
Within 10%	-	-	-
		Job 6	
Within 5%	A	-	A*
Within 7.5%	-	-	A*
Within 10%	A	-	A*

Top F

Top E

Top D

Top C

Top B

Top A

Table 4. Display of the Significant Difference in Percentage Deviations Between the Unaided and the Aided Situations in the Class B Ratings from the Viewpoint of Accuracy, at the 5% Level of Significance.

Key:

- means that no significant difference was found.
* means that the difference was significant also at the 1% level of significance.
A means that the difference was against the use of the loop.
F means that the difference was in favor of the use of the loop.

Table 6. Tabled of the significant differences in
percentage deviations between the Untreated and the Fixed
Vocabulary, at the 5% level of significance.

Key:

- means that no significant difference was found.
- means that the difference was significant also at the 1% level of significance.

I means that the difference was in favour of the new type.
I means that the difference was in favour of the old type.

	Slow pace	Medium pace	Fast pace
		Job 1	
Within 5%	-	-	-
Within 7.5%	F*	F	-
Within 10%	F*	F	-
		Job 2	
Within 5%	F*	-	-
Within 7.5%	-	-	F*
Within 10%	-	-	F*
		Job 3	
Within 5%	F	-	F
Within 7.5%	-	F*	F*
Within 10%	-	F*	F*
		Job 4	
Within 5%	-	-	F*
Within 7.5%	F	-	-
Within 10%	-	-	-
		Job 5	
Within 5%	-	-	-
Within 7.5%	-	-	-
Within 10%	F*	-	-
		Job 6	
Within 5%	-	-	-
Within 7.5%	A	-	-
Within 10%	-	-	-

			slow pace Indian pace fast pace
	top 1		
nitrin 5%	-	-	-
nitrit 7.5%	½	1	-
nitrin 10%	½	1	-
	top 2		
nitrin 5%	½	-	-
nitrit 7.5%	-	-	½
nitrin 10%	-	-	½
	top 3		
nitrin 5%	½	-	-
nitrit 7.5%	-	½	½
nitrin 10%	-	½	½
	top 4		
nitrin 5%	-	-	½
Nitrit 7.5%	½	-	-
Nitrin 10%	-	-	-
	top 5		
nitrin 5%	-	-	-
nitrit 7.5%	-	-	-
nitrin 10%	½	-	-
	top 6		
nitrin 5%	-	-	-
nitrit 7.5%	½	-	-
nitrin 10%	-	-	-

Table 5. Percentages of the Class A Ratings Within Given Percentage Deviations from the Raw Ratings Averages (Consistency) in the Aided and in the Unaided Situations.

Film No.	5%		7.5%		10%	
	U	A	U	A	U	A
1.	27.10	11.71	28.97	18.92	47.66	20.72
2.	27.36	27.93	43.39	44.14	57.58	58.56
3.	24.30	26.13	37.38	40.54	47.66	53.15
4.	22.43	13.51	22.43	27.03	60.75	42.34
5.	13.21	45.05	41.51	54.05	54.72	63.00
6.	20.75	18.18	44.34	21.82	44.34	37.27
7.	18.69	24.54	19.63	28.18	53.27	40.00
8.	41.12	37.27	41.12	62.73	43.93	71.82
9.	24.30	40.91	65.42	50.00	69.16	59.09
10.	25.23	32.43	29.91	44.14	29.91	59.46
11.	13.08	30.91	31.78	40.00	31.78	49.09
12.	46.73	29.36	61.68	39.45	63.55	55.05
13.	29.91	26.13	62.62	49.55	64.49	55.86
14.	14.95	45.95	14.95	62.16	62.62	67.57
15.	33.64	36.94	65.42	47.75	70.09	50.45
16.	22.43	27.03	45.79	45.95	50.47	53.56
17.	21.50	31.53	38.32	41.44	44.86	46.85
18.	23.36	32.43	43.93	51.35	56.07	61.26

Key: U; Unaided; A: Aided Situation.

Table 5. Improvement of the Glucose & Insulin given intravenous Devitions from the Non Fasting Average (Overnight) in the Aided and in the Unaided Situation.

File No.

	5%		7.5%		10%	
	U	A	U	A	U	A
1.	37.10-11.71		88.97-18.95		47.85-50.73	
2.	37.25-47.93		83.89-44.14		87.38-54.86	
3.	24.20-30.19		37.65-40.84		47.64-60.13	
4.	22.12-19.81		32.45-37.03		80.73-42.34	
5.	19.21-43.03		41.81-38.00		84.73-85.00	
6.	20.78-19.18		44.34-31.85		44.34-37.87	
7.	18.89-24.34		19.83-83.18		82.37-60.00	
8.	41.12-37.87		41.18-42.73		43.93-71.85	
9.	24.30-40.91		33.42-30.00		89.18-30.09	
10.	28.23-23.43		29.31-44.14		39.81-34.44	
11.	12.03-30.81		21.78-40.00		21,76-40.09	
12.	44.73-29.34		21.88-39.43		85.32-85.09	
13.	29.81-36.13		32.82-29.33		84.49-33.89	
14.	14.93-43.83		14.98-34.18		82.22-47.87	
15.	33.84-34.34		39.42-47.78		70.09-30.48	
16.	22.43-37.00		48.78-43.98		30.47-38.38	
17.	21.80-21.32		28.32-41.44		44.88-48.88	
18.	23.34-24.43		43.83-21.33		84.87-81.84	

Key: U; Unaided; A; Aided Situation.

Table 6. Student's t Values Calculated to Test the Difference Between the Values Given for the Unaided and the Aided Situations in Table 5.

Film No.	5%	7.5%	10%
1.	2.874	1.738	4.196
2.	0.094	0.111	0.147
3.	0.312	0.480	0.811
4.	1.719	0.789	2.720
5.	5.186	1.855	1.240
6.	0.310	3.560	1.065
7.	1.050	1.482	1.966
8.	0.584	3.197	4.188
9.	2.624	2.311	1.552
10.	1.176	2.179	7.103
11.	3.184	1.267	2.597
12.	2.644	3.280	1.280
13.	0.477	1.948	1.306
14.	4.984	7.164	0.769
15.	0.510	2.673	2.967
16.	0.788	0.011	1.200
17.	1.683	0.471	0.295
18.	1.494	1.099	0.779

Table 6. Student's t Values Calculated to Test the Difference Between Mid Values Given for the Unaided and the Aided Situations in Table 5.

File No.	$\bar{x}$		t
1.	2.474	7.04	10.8
2.	0.094	3.788	6.198
3.	0.814	0.111	0.167
4.	1.818	0.888	0.811
5.	0.788	0.788	2.760
6.	0.810	1.888	1.340
7.	1.030	2.380	1.088
8.	0.284	1.488	1.966
9.	2.814	2.177	4.188
10.	1.178	2.311	1.888
11.	2.184	2.178	7.108
12.	2.844	1.847	5.897
13.	0.477	2.888	1.800
14.	4.884	1.948	1.308
15.	0.810	7.184	0.780
16.	0.788	4.078	2.847
17.	1.808	0.011	1.800
18.	1.484	0.871	0.888
		1.088	0.778

Table 7. Percentages of the Class B Ratings Within Given Percentage Deviations from the Raw Ratings Averages (Consistency) in the Unaided and the Aided Situations.

Film No.	5%		7.5%		10%	
	U	A	U	A	U	A
1.	42.86	11.76	52.38	23.53	61.90	47.07
2.	38.10	66.67	38.10	72.22	66.67	72.22
3.	52.38	22.22	52.38	55.56	80.95	55.56
4.	33.33	33.33	57.14	44.44	71.43	50.00
5.	38.10	50.00	47.62	77.78	57.14	83.33
6.	14.29	22.22	47.62	33.33	52.38	66.67
7.	33.33	33.33	33.33	61.11	47.62	72.22
8.	33.33	50.55	38.10	83.33	66.67	94.44
9.	42.86	22.22	61.90	50.00	66.67	50.00
10.	52.38	47.06	52.38	58.82	61.90	70.59
11.	23.81	33.33	28.57	72.22	42.86	72.22
12.	38.10	22.22	38.10	22.22	61.90	66.67
13.	33.33	22.22	52.38	33.33	57.14	33.33
14.	61.90	38.89	61.90	66.67	80.95	77.78
15.	47.62	22.22	66.67	33.33	71.43	50.00
16.	38.10	27.78	47.62	38.89	47.62	44.44
17.	14.29	27.78	23.81	27.78	28.57	44.44
18.	33.33	27.78	33.33	38.89	57.14	66.67

Key: U: Unaided situation; A: Aided situation.

Table 7. Performance of the Class B Savings Certain Class Percentage Derivations from the Raw Ratings Averages (Consistency) in the Ranked and the Added Situations.

Title No.	0%		7.5%		10%	
	U	A	B	A	U	A
1.	42.8E-11.79		0E.3E-E8.0E		87.10-47.07	
2.	3E.10-69.07		58.10-78.8E		06.07-78.2E	
3.	02.[illegible]-E[illegible].8E		81.3E-39.86		00.90-E0.3E	
4.	0[illegible].3E-E0.53		37.18-14.44		71.42-20.00	
5.	01.10-30.00		47.0[illegible]-77.78		37.14-82.33	
6.	14.[illegible]-[illegible].2E		47.02-E3.3E		03.38-0[illegible].07	
7.	33.3E-13.33		33.33-61.11		47.08-71.2E	
8.	03.2E-00.3E		3E.10-02.3E		0E.07-14.44	
9.	41.00-E1.8E		81.40-30.00		00.07-30.00	
10.	01.3E-47.0E		02.3E-3E.8E		81.40-70.3E	
11.	31.[illegible]-32.E3		E8.3[illegible]-72.18		18.8E-74.1E	
12.	3E.10-E1.1E		3E.10-E2.1A		01.40-E0.07	
13.	03.3E-E1.E3		02.3E-3E.2E		37.14-03.3E	
14.	01.40-3A.=3		81.40-E0.07		80.3E-77.78	
15.	07.E3-8E.1E		00.07-23.2E		71.43-00.00	
16.	3E.10-27.78		47.E3-3E.8E		47.83-E4.44	
17.	1E.2A-87.78		E8.31-37.78		2E.37-E4.44	
18.	23.33-17.78		E3.23-3A.0E		37.14-0E.87	

Key: U: Unranked alternative; A: Ranked alternative.

Table 8. Student's t Values Calculated to Test the Difference Between the Values Given for the Unaided and the Aided Situations in Table 7.

Film No.	5%	7.5%	10%
1.	2.145	2.117	0.932
2.	1.780	2.130	0.374
3.	1.929	0.202	1.713
4.	0	0.791	1.382
5.	0.747	1.929	1.765
6.	0.644	0.904	0.904
7.	0	1.734	1.557
8.	1.089	2.862	2.141
9.	1.363	0.747	1.055
10.	0.331	0.326	0.572
11.	0.658	2.720	1.844
12.	1.072	1.072	0.310
13.	0.768	1.197	1.486
14.	1.434	0.310	0.244
15.	1.648	2.077	1.382
16.	0.682	0.545	0.198
17.	1.040	0.284	1.030
18.	0.374	0.361	0.610

Table 6. Student's t Values Calculated to Test the Difference Between the Values Given for the Parties and the Final Selections in Table 7.

Item No.	Dem	Rep	Log
1.	2.160	3.117	0.958
2.	1.780	2.130	0.374
3.	1.859	0.808	1.718
4.	0	0.781	1.082
5.	0.717	1.889	1.765
6.	0.644	0.904	0.804
7.	0	1.734	1.037
8.	1.289	2.805	2.161
9.	1.243	0.747	1.049
10.	0.851	0.730	0.373
11.	0.809	2.750	1.044
12.	1.078	1.072	0.319
13.	0.768	1.187	1.488
14.	1.054	0.510	0.344
15.	1.848	2.077	1.382
16.	2.884	0.263	0.748
17.	1.060	0.788	1.029
18.	0.878	0.861	0.019

Table 9. Percentages of the Class A Ratings Within Given Percentage Deviations from the Corrected Ratings (Accuracy) in the Unaided and the Aided Situations.

Film No.	5%		7.5%		10%	
	U	A	U	A	U	A
1.	14.95	17.12	16.81	34.23	24.30	45.94
2.	19.91	29.73	42.45	51.35	41.11	59.46
3.	16.82	19.81	30.84	31.53	36.45	39.64
4.	1.87	6.31	2.80	24.32	5.61	30.61
5.	6.60	16.21	6.60	21.62	6.60	21.62
6.	19.81	22.27	37.83	36.36	37.92	45.45
7.	0.93	15.45	3.74	24.54	13.08	33.64
8.	2.80	12.73	11.21	32.73	11.21	53.64
9.	45.79	41.82	47.66	51.82	69.16	60.91
10.	38.32	36.94	58.88	52.25	60.75	63.96
11.	5.61	17.27	5.61	24.54	7.48	40.00
12.	21.49	28.44	26.17	37.61	26.17	50.46
13.	3.74	9.90	11.21	21.62	13.08	23.42
14.	47.66	47.75	51.40	64.86	58.88	70.27
15.	40.19	36.04	65.42	49,55	69.16	56.76
16.	4.67	19.82	43.92	54.05	43.92	54.95
17.	20.56	32.43	41.12	41.44	44.86	45.96
18.	23.36	27.93	44.86	50.45	48.60	60.36

Key: U: Unaided situation; A: Aided situation.

Table 8. Correspondence of the three X relative viewin
Other Reconstructions from the Corrected Perspe
(Vocalvect) in the Original and the Wind Directions.

Item No.	5%	7.5%	10%
	D A	D A	D A
1.	14.60-17.12	19.61-64.22	64.30-69.64
2.	19.31-20.72	42.46-21.20	47.17-20.46
3.	10.05-14.21	20.04-21.05	20.49-20.64
4.	1.87- 6.21	6.30-04.32	9.61-20.67
5.	6.00-19.11	6.00-21.63	9.00-21.20
6.	18.81-22.37	27.82-24.36	27.02-19.40
7.	0.32-13.40	2.74-24.04	12.08-29.04
8.	4.00-12.72	11.11-32.72	11.11-20.64
9.	40.70-41.80	47.00-01.80	50.10-20.71
10.	20.02-00.04	20.02-20.20	20.70-20.00
11.	2.81-17.17	5.07-24.24	7.00-40.00
12.	41.40-00.44	20.17-07.01	20.17-20.40
13.	3.74- 9.00	17.11-11.02	18.02-22.12
14.	47.00-47.70	21.20-04.00	20.00-40.17
15.	40.10-00.04	10.02-40.22	00.10-00.70
16.	4.01-10.02	02.02-34.00	40.04-04.00
17.	20.00-22.40	41.12-41.44	44.20-42.70
18.	22.04-17.02	44.00-20.40	02.20-00.20

Key: D: Dualed attraction; A: tilted attraction.

Table 10. Student's t Value Calculated to Test the Difference Between the Values Given for the Unaided and the Aided Situation in Table 9.

Film No.	5%	7.5%	10%
1.	0.438	2.966	3.360
2.	1.684	1.322	1.686
3.	0.573	0.110	0.487
4.	1.662	4.668	4.817
5.	2.266	3.196	3.196
6.	0.447	0.225	1.132
7.	0.279	0.225	0.360
8.	2.758	0.385	0.671
9.	0.594	0.617	1.283
10.	0.211	0.989	0.491
11.	0.855	3.945	6.000
12.	1.192	1.821	4.432
13.	1.604	2.082	1.988
14.	0.013	2.024	1.765
15.	0.633	2.382	1.898
16.	3.435	1.502	1.636
17.	1.994	0.048	0.164
18.	0.778	0.830	1.752

Table 11. Percentages of the Class B Ratings Within Given Percentage Deviations from the Corrected Ratings (Accuracy) in the Unaided and the Aided Situations.

Film No.	5%		7.5%		10%	
	U	A	U	A	U	A
1.	38.09	23.53	47.62	23.53	57.14	35.29
2.	19.09	66.67	33.33	72.22	38.09	72.22
3.	42.86	5.55	52.38	5.55	71.42	16.67
4.	28.57	11.11	38.09	16.67	42.86	44.44
5.	14.28	38.89	14.28	55.55	14.28	61.11
6.	42.86	27.78	47.62	33.33	47.62	55.55
7.	4.76	33.33	4.76	50.00	19.05	72.22
8.	4.76	38.89	14.28	66.67	23.81	72.22
9.	42.85	38.89	47.61	38.89	71.43	61.11
10.	47.62	47.05	61.90	58.82	61.90	70.59
11.	14.28	33.33	14.28	44.44	33.33	72.22
12.	47.62	27.78	52.38	38.89	52.38	50.00
13.	19.05	22.22	38.10	38.89	47.62	44.44
14.	61.90	38.89	71.42	61.11	80.95	66.67
15.	47.62	16.67	52.38	33.33	71.42	38.89
16.	9.52	11.11	42.86	38.89	42.86	38.89
17.	14.28	38.89	19.05	44.44	23.81	55.55
18.	23.81	33.33	71.42	66.67	71.42	66.67

Key: U: Unaided situation; A: Aided situation.

1.	[illegible]	[illegible]	[illegible]
2.	[illegible]	[illegible]	[illegible]
3.	[illegible]	[illegible]	[illegible]
4.	[illegible]	[illegible]	[illegible]
5.	[illegible]	[illegible]	[illegible]
6.	[illegible]	[illegible]	[illegible]
7.	[illegible]	[illegible]	[illegible]
8.	[illegible]	[illegible]	[illegible]
9.	[illegible]	[illegible]	[illegible]
10.	[illegible]	[illegible]	[illegible]
11.	[illegible]	[illegible]	[illegible]
12.	[illegible]	[illegible]	[illegible]
13.	[illegible]	[illegible]	[illegible]
14.	[illegible]	[illegible]	[illegible]
15.	[illegible]	[illegible]	[illegible]
16.	[illegible]	[illegible]	[illegible]
17.	[illegible]	[illegible]	[illegible]
18.	[illegible]	[illegible]	[illegible]
19.	[illegible]	[illegible]	[illegible]
20.	[illegible]	[illegible]	[illegible]

Table 12. Student's t Value Calculated to Test the Difference Between the Values Given for the Unaided and the Aided Situation in Table 11.

Film No.	5%	7.5%	10%
1.	0.977	1.557	1.363
2.	3.011	2.423	4.558
3.	2.666	3.159	3.417
4.	1.346	1.481	0.992
5.	1.759	2.726	3.038
6.	0.978	0.904	0.494
7.	1.808	2.818	3.340
8.	2.144	3.352	3.022
9.	0.251	0.548	0.682
10.	0	0.196	0.572
11.	1.408	2.085	2.423
12.	1.269	0.842	0.148
13.	0.244	0	0.198
14.	1.434	0.682	1.021
15.	2.044	1.197	2.043
16.	0.163	0.249	0.249
17.	1.759	1.713	2.030
18.	0.658	0.320	0.320

Table 12. Boundary 1 Value Calculated To Test the Difference Between the Means Given Our Grades and Those Given in Table 11.

Tile No.	3%	7.5%	10%
1.	0.377	1.057	1.502
2.	5.021	4.482	4.209
3.	4.469	3.129	3.417
4.	3.414	1.481	0.902
5.	1.729	2.726	3.039
6.	0.919	0.704	0.494
7.	1.305	3.019	3.560
8.	3.144	3.302	3.022
9.	0.181	0.348	0.482
10.	0	0.139	0.373
11.	1.408	2.039	2.458
12.	1.329	0.842	0.149
13.	0.449	0	0.178
14.	1.404	0.382	1.021
15.	8.044	7.147	6.049
16.	0.103	0.349	0.469
17.	1.781	1.178	0.000
18.	0.389	0.000	0.000

Table 13. Values of the Means of the Raw Ratings in the Unaided and the Aided Situations for Each of the Two Groups (A and B) Used as a Basis for the Study of Consistency.

Film No.	Class A		Class B	
	U	A	U	A
1.	88.79	106.21	99.19	111.12
2.	122.12	125.29	119.52	128.61
3.	127.90	127-97	120.52	139.55
4.	93.06	107-40	105.33	115.94
5.	137.12	153.96	154.76	170.83
6.	117.96	108.83	106.90	105.28
7.	103.64	125.00	114.76	138.67
8.	136.10	151.67	142.90	159.11
9.	106.59	105.19	104.38	112.44
10.	89.40	98.86	99.38	99.71
11.	112.66	129.84	131.14	149.67
12.	97.85	92.04	91.90	88.00
13.	93.70	105.68	103.67	111.78
14.	92.89	99.79	97.38	106.11
15.	94.53	94.67	98.57	94.17
16.	75.73	85.87	85.95	90.50
17.	83.90	95.90	91.86	105.17
18.	128.44	129.36	119.67	130.39

Note: The films selected as those where best agreement between ratings were found are: 1, 10, 14, 17, 18 and 15.

Table 16. Ratings of the amount of time Dan walking by Dan Donald and the mixed differences for Dan of the two Groups (A and B) Used as a Basis for the study of Dependency.

Rtg No.	Group A		Group B	
	D	A	D	A
1.	88.69-106.21		98.12-111.18	
2.	130.12-143.89		116.22-128.01	
3.	139.80-127-27		120.02-130.35	
4.	98.09-107-90		100.29-110.04	
5.	107.52-103.96		104.78-120.89	
6.	117.38-103.83		106.96-103.38	
7.	109.44-123.00		116.70-129.97	
8.	102.10-101.07		102.80-129.11	
9.	109.39-109.19		106.09-113.44	
10.	88.40- 89.98		93.08- 99.73	
11.	112.80-129.84		101.10-140.67	
12.	93.89- 92.04		93.40- 98.00	
13.	93.70-109.84		109.67-111.74	
14.	92.89- 89.79		97.08-100.11	
15.	93.09- 94.87		90.37- 94.17	
16.	70.75- 83.87		89.69- 80.80	
17.	89.90- 99.90		91.89-103.17	
18.	130.44-129.38		114.97-130.38	

Note: The ratings maintained as close above their expressed between ratings were found are: 1, 10, 14, 17, 18 and 18.

Table 14. Corrected Ratings Taken as Basis for the Study of Accuracy.

Film No.	Corrected Ratings
1.	101.33
2.	123.80
3.	115.94
4.	111.48
5.	117.95
6.	104.29
7.	141.86
8.	170.84
9.	101.45
10.	96.84
11.	146.55
12.	90.69
13.	118.22
14.	99.04
15.	95.48
16.	84.26
17.	94.21
18.	126.96

Table 12. Corrected Reading Table to Obtain Top Gun Sheet of Accuracy.

File No.	Corrected Reading
1.	101.20
2.	102.60
3.	110.60
4.	111.60
5.	112.00
6.	104.80
7.	101.00
8.	100.60
9.	101.80
10.	96.20
11.	104.20
12.	90.60
13.	110.20
14.	99.00
15.	98.80
16.	96.20
17.	94.01
18.	102.80

FIGURE 1

GRAPHICAL DISPLAY OF THE RAW RATINGS AVERAGES
OF GROUP A
IN THE UNAIDED AND IN THE AIDED SITUATION

Fig. 1

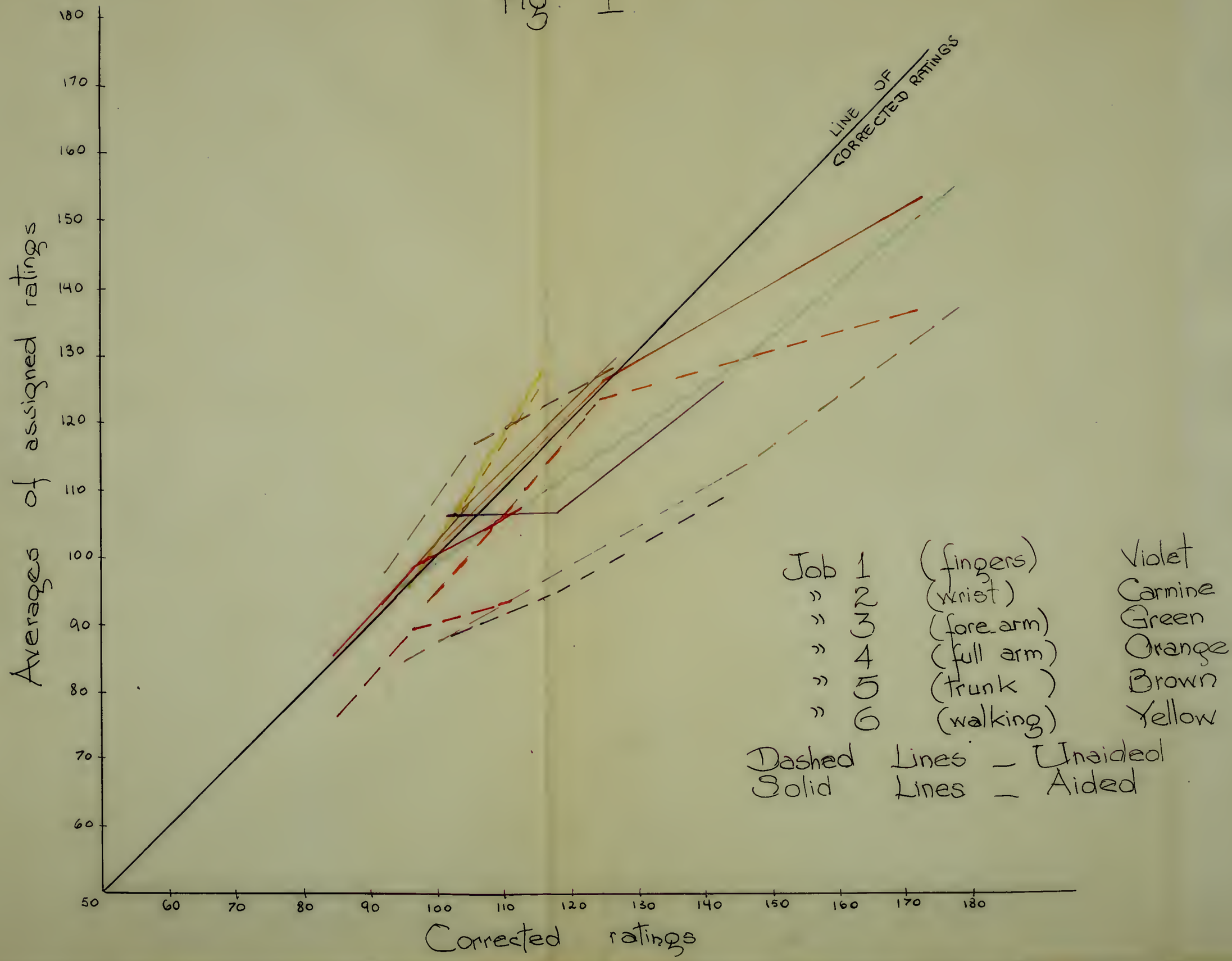
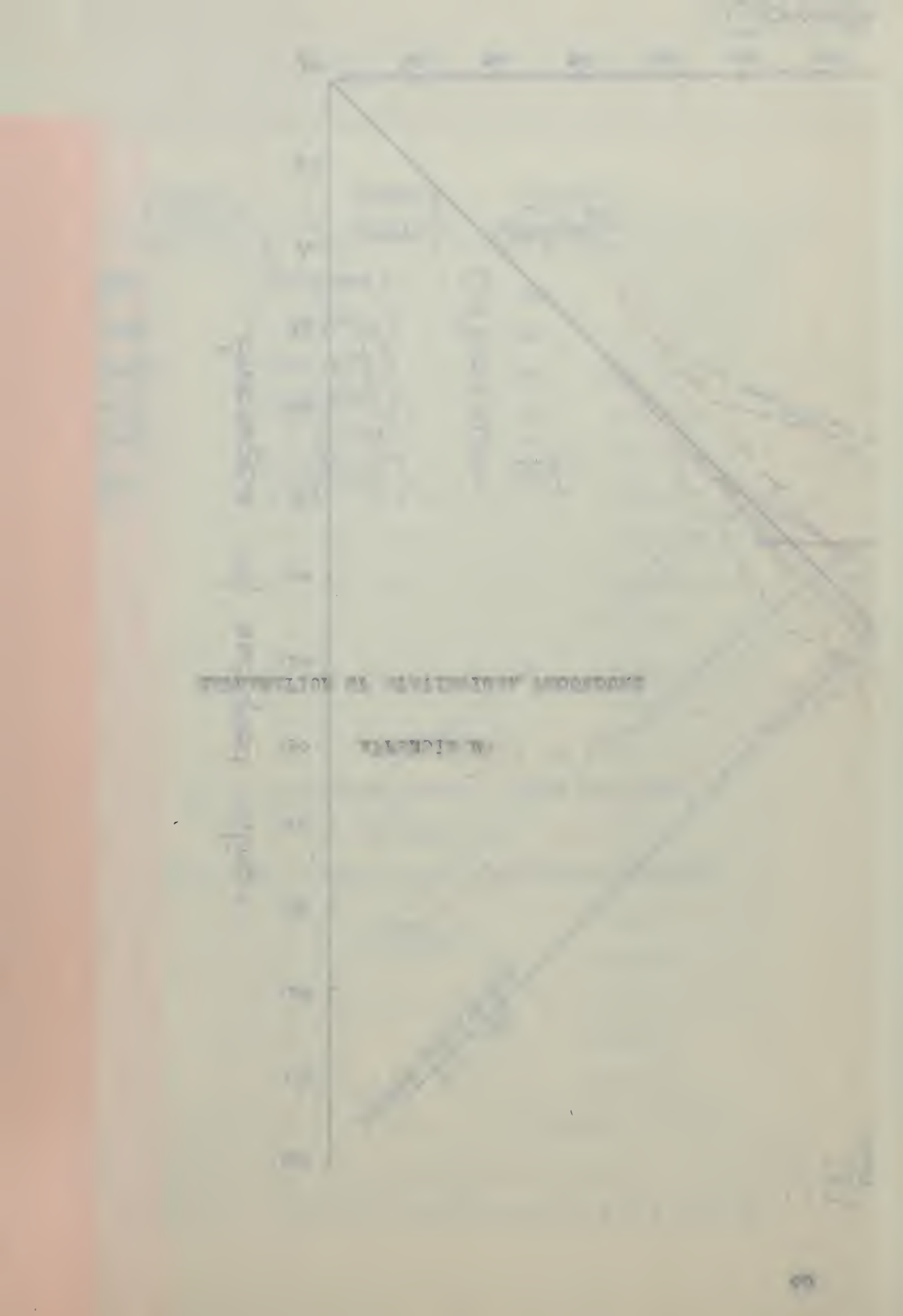

LINE OF CORRECTED RATINGS
Averages of assigned ratings
Corrected ratings
50
60
70
80
90
100
110
120
130
140
150
160
170
180
Job 1 (fingers) Violet
" 2 (wrist) Carmine
" 3 (fore_arm) Green
" 4 (full arm) Orange
" 5 (trunk) Brown
" 6 (walking) Yellow
Dashed Lines – Unaided
Solid Lines – Aided

Fig 1

LINE OF CORRECTED RATINGS
Job 1
" " 2
" " 3
" " 4
Dashed Lines
Solid Lines
Average of Ranked Results
Corrected

APPENDIA B

EXPLANATION OF STATISTICAL PROCEDURE



EXPLANATION OF STATISTICAL PROCEDURE

The percentages of ratings within given percentage deviations from the raw averages and from the corrected ratings, found respectively in the studies of consistency and accuracy, were tested for significance by means of the Student's t variable.

This test requires the assumption that the ratings obtained came from a normally distributed population.(12)

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12. Edwards, A., "Experimental design in Psychological Research", New York, Mc Graw-Hill Book Co., 1950.

This assumption was made as explained in the Data section of this thesis.

The formula used to express Student's t variable was:

$$t = \frac{p_1 - p_2}{e}$$

where p_1 is the percentage deviation from the raw ratings average, in the consistency study, or from the corrected rating, in the accuracy study, in the unaided situation; p_2 is the same statistics in the aided situation and e is the standard error of the quantity $p_1 - p_2$, being given by the formula:

the determents of testing might given determine
qualitative type the two statuses and type the correspond
ratings, types characteristic in the station of connivement
peg "contract", data denote the significance of mean of the
measure's a testimate.

This debt relation the assumption when the testing de-
pained cause time a normally directional isotropic.[18]

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18. Fenster, W., "Differential Genius in Mathematics", New York, The Cyan-Tit Book Co., 1930.

This assumption may mind be obtained in the true section
of axis ensure.

The formula need to achieve Jupiter's a variable may:

$$E = \frac{\quad}{\delta' - \delta^E}$$

given β the mean statistics in the sized alternation and $\overline{E}$
β^E is the determents deviation time the two testing
mean β' is the determents deviation time the two testing
testing, the the counterpond stand, the the modified alternation;
station, the the calculated stand, to the mutual alternation;
station, the the counterpond stand, or time the correspond
station, the the calculated stand, to the mutual alternation;
β^E is the mean statistics in the sized alternation and $\overline{E}$
given β the comment:

$$e = \sqrt{ab\,(1/n_1 + 1/n_2)}$$

where:

$$a = \frac{n_1 p_1 + n_2 p_2}{n_1 + n_2} \qquad \text{and} \qquad b = 1 - a$$

and n_1 and n_2 are the number of ratings used in each situation. The number of degrees of freedom is given by the formula:

$$\text{d. f.} = n_1 + n_2 - 2$$

The test consisted of proposing the hypothesis that the percentage deviations found were typical percentage deviations drawn from a normal population. The value of t was calculated and compared with the limiting values of t given by a table.(13) If the value of t calculated is

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13. C. C. Peters and R. Van Voorhis, "Statistical Procedures and Their Mathematical Basis", New York, Mc Graw-Hill Book Co., 1940.

---

greater than the table value, at the level of significance chosen, the hypothesis is not tenable; in other words, there is a difference between the two percentages considered which is greater than should be expected of typi-

$$\alpha = \sqrt{\tan\left(1/\sigma_1^2 + 1/\sigma_2^2\right)}$$

where:

$$\alpha = \frac{\sigma_1^2\sigma_2^2}{\sigma_1^2 + \sigma_2^2} \qquad \text{and} \qquad \beta = 1 - \alpha$$

and σ_1^2 and σ_2^2 are the number of setting used in each direction. The number of degrees of freedom is given by the formula:

$$d.f. = n_1^2 + n_2^2 - 2$$

The test consisted of plotting the diplopemia that the paracentric deviations found were diplopemic about normal polarization. The value of χ^2 was calculated and compared with the tabled values of χ^2 given by a table.(39) If the value of χ^2 obtained is

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(39) G. G. Lehrs and E. Van Voorhis, "Statistical Procedures and Their Mathematical Basis", New York, McGraw-Hill Book Co., 1940.

---

greater than the table value, at any level of significance, the diplopemia is not imposed; it does exist, there is a difference between the two paracentric deviations which is greater than would be expected of diplopemia

cal percentage deviations drawn from normal population.

Two levels of significance were chosen: 1% and 5%.

Statistically speaking, a statement is made at the n% level of significance when one has only n chances out of 100 that the statement made is not true.

The limiting values of t for the number of degrees of freedom involved in all cases were:

At 1% level of significance: $t = 2.58$

At 5% level of significance: $t = 1.97$

The number of ratings obtained were as follows:

Group A

Unaided: 107

Aided: 111

Group B

Unaided: 21

Aided: 18

.ont percentage deviations drawn from normal population.

Two levels of significance were chosen: 1% and 5%.

Specifically speaking, a statement is made at the 5%

level of significance when one has only a chance out of

100 that the statement made is not true.

The limiting values of t for the number of degrees of

freedom listed in six cases were:

At 1% level of significance: $t = 2.90$

1% 5% level of significance: $t = 1.97$

The number of ratings obtained were as follows:

Group A

Omitted: 107

Kept: 111

Group B

Omitted: 91

Kept: 79

APPENDIX C

SAMPLE CALCULATIONS

SAMPLE CALCULATIONS

Calculation of mean or average values, example from Group B, unaided, film no. 1:

$$M = \frac{\sum \text{ratings}}{\text{No. of ratings}} = \frac{2083}{21} = 99.19$$

Calculations of the percentage of ratings within given percentage deviations from the corrected ratings, example from Group A, unaided, film no. 1:

$$M = 101.33$$

$M \pm 5\%$	$M \pm 7.5\%$	$M \pm 10\%$
96.26 to 106.40	93.37 to 108.93	91.20 to 111.46
$\frac{100 \times 16}{107} = 14.95$	$\frac{100 \times 18}{107} = 16.82$	$\frac{100 \times 26}{107} = 24.30$

Calculations of Student's t values, example from Group A, accuracy, film no. 1, within 5%:

$$t = \frac{0.1712 - 0.1495}{\sqrt{0.1603 \times 0.8397 \left(1/107 + 1/107 \right)}} = 0.438$$

Significance: not significant at both 1% and 5% levels.

Answers to Exercises

Operation of mean of values given, example line
drawn 'upward' like so: ↑:

$$\bar{x} = \frac{\text{sum of values}}{\text{no. of values}} = \frac{1003}{11} = 99.18$$

Operation of the percentage of values right given
percentage deviations from the computed results, example
line drawn 'upward' like so: ↑:

$$\bar{x} = 101.36$$

$\bar{x} \pm 3\sigma$	$\bar{x} \pm 2\sigma$	$\bar{x} \pm 1\sigma$
82.38 to 106.60	87.21 to 106.82	91.30 to 111.42

$$\frac{100 \times 16}{101} = 14.82 \qquad \frac{100 \times 19}{101} = 18.81 \qquad \frac{100 \times 56}{101} = 54.46$$

Operations of standard's t values, example line drawn
'downward' like so: ↓, simple OP:

$$r = \frac{0.7178 - 0.1580}{\sqrt{(1/24 + 1/104)\ 0.7308 \times 0.2692}} = 0.438$$

Significance: our significant at only 1% and 5% tests.

Metronome beats and frames per cycle

Film no.	Metronome	Frames/cycle
1	120	9
2	100	21
3	176	14
4	80	13
5	204	10
6	70	29
7	168	6
8	138	15
9	154	16
10	70	15
11	168	12
12	60	33
13	144	7
14	80	26
15	130	19
16	60	17
17	108	19
18	84	24

Telephone books and license tax data

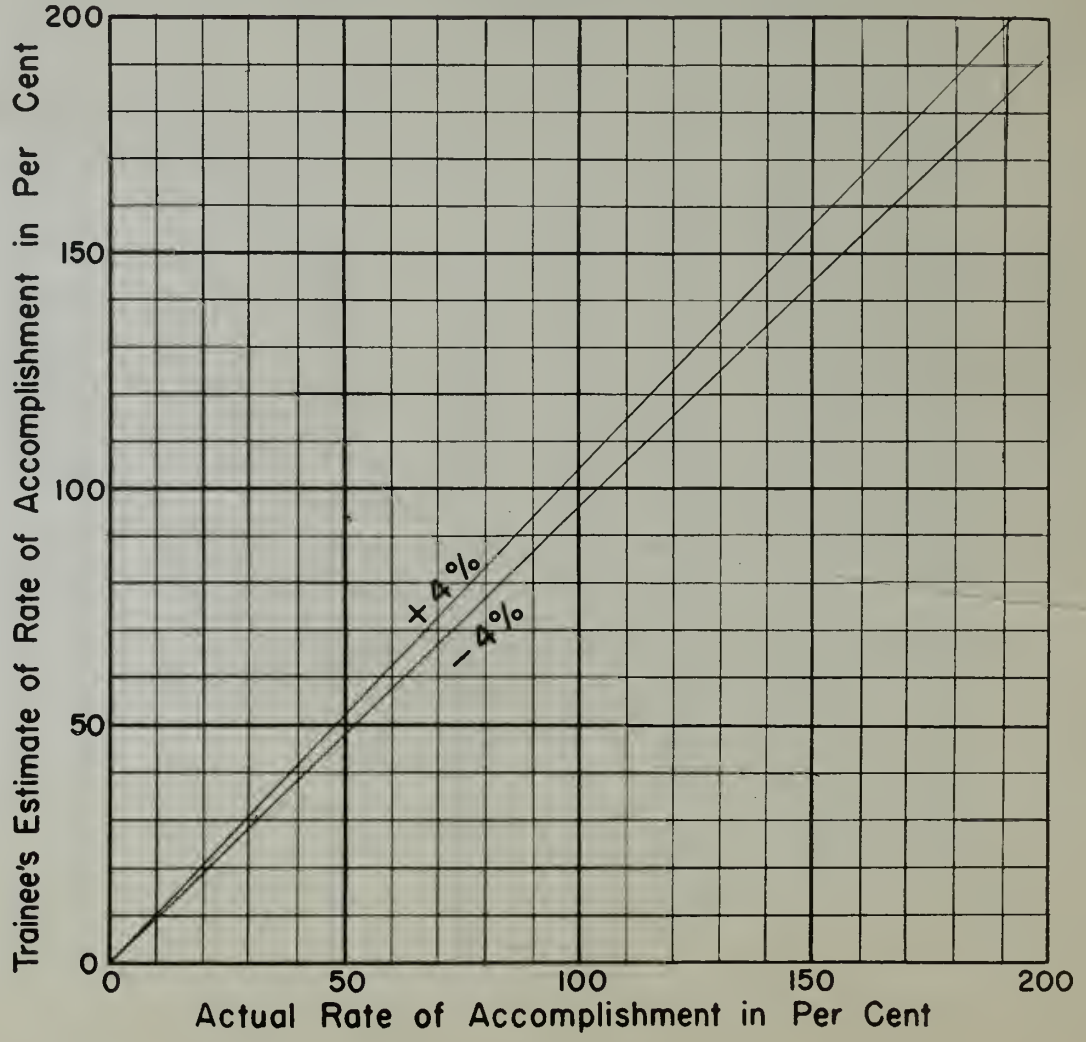
File No.	Telephone	Kansas/Dixie
1	120	8
2	100	21
3	176	14
4	80	12
5	104	10
6	70	26
7	160	6
8	130	15
9	174	19
10	40	15
11	160	12
12	100	32
13	144	7
14	60	26
15	130	16
16	90	17
17	108	16
18	84	24

RATING EFFICIENCY COMPARISON SHEET NO. ___

OPERATION _____

Sequence Number	Rating of Accomplishment in Per Cent	
	Trainee's	Actual
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		

COMPARISON GRAPH

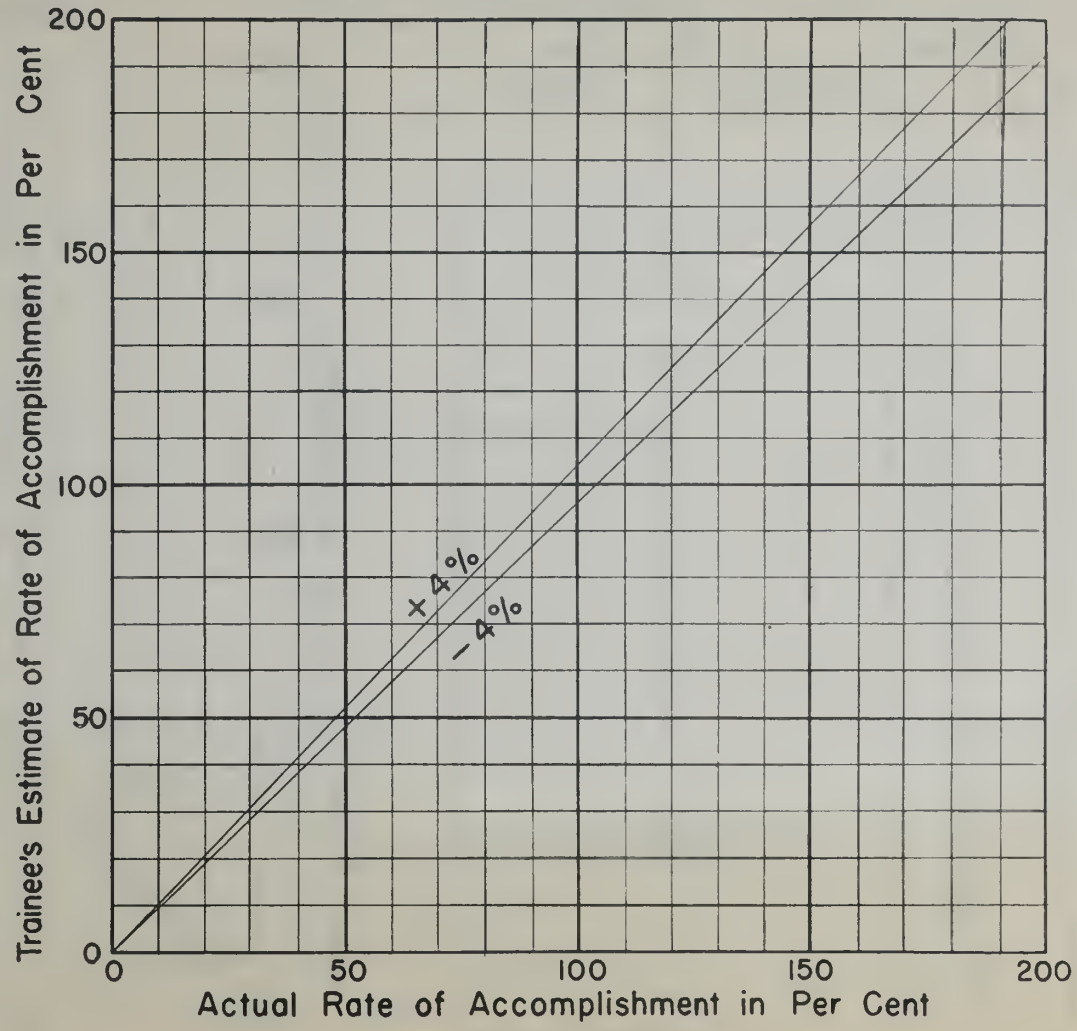


RATING EFFICIENCY COMPARISON SHEET NO. ___

OPERATION _____

Sequence Number	Rating of Accomplishment in Per Cent	
	Trainee's	Actual
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		

COMPARISON GRAPH



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Thesis 15636
M685 Monteiro
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